

AIRS Minor Constituents Focus Group:

Turning small residuals into science

Wallace McMillan, Juying Warner, Michele McCourt Comer,
Larrabee Strow, Sergio De-Souza Machado,
Scott Hannon (UMBC/JCET),
Mous Chahine, Sung-Yung Lee, Ed Olsen, Luke Chen,
Eric Fetzer, Evan Manning, Bill Irion, Brian Kahn (JPL),
C. Barnet and Eric Maddy (NOAA/NESDIS),
Joel Susskind and John Blaisdell (NASA GSFC)

GOALS

- 1. Get as many minor constituent products ready for v5.0 PGE as possible**
- 2. Must have averaging kernels**
- 3. Validate v5.0 PGE minor constituent products**
- 4. Continue minor constituent retrieval development beyond v5.0 PGE**

Summary

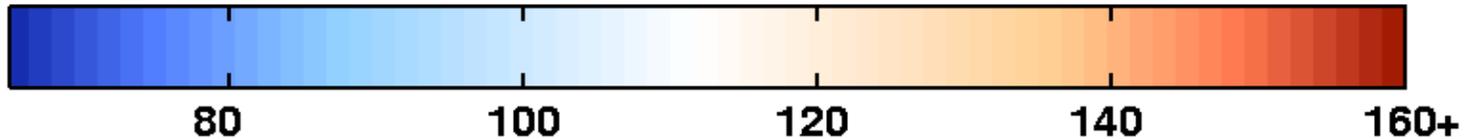
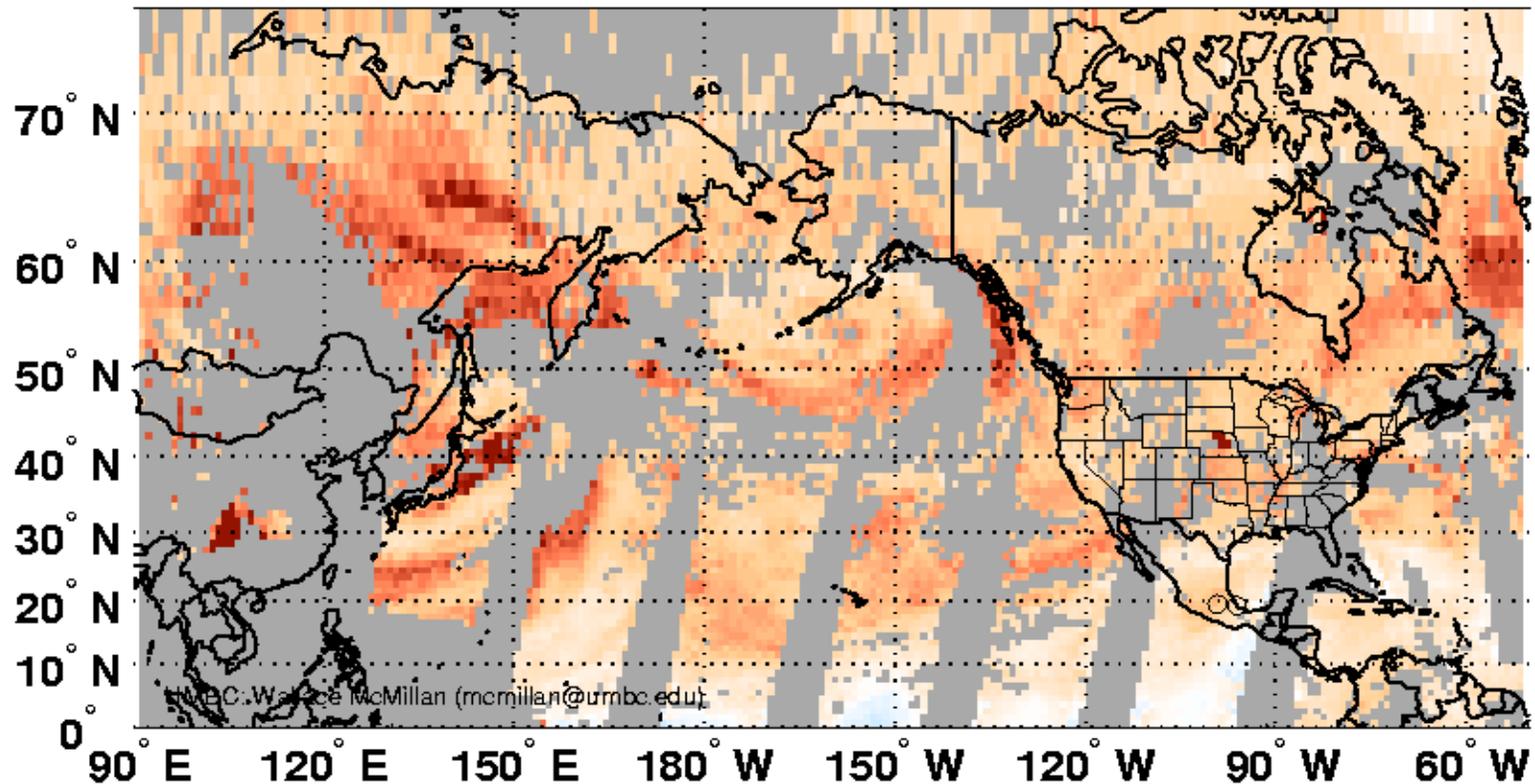
- **CO** v5 Standard Product
- **CH₄** v5 Standard Product
- **SO₂** v5.0 flag, L1B PGE; **retrieval v6.0?**
- **dust** v5.0 score, L1B PGE; **retrieval v6.0?**
- **H₂O** averaging kernel output in v5
- **O₃** averaging kernel output in v5
- **CO₂** v5 Support Product
- **HNO₃** **column retrieval for v6?**
- **N₂O** **column retrieval for v6?**
- **CFC's** little signal apparent in data

Minor Constituents Talks

- Averaging kernels – Maddy (Thurs 8:50AM)
- O₃
 - Irion (Thurs 8:30AM)
 - Divarkarla (Thurs 9:10AM)
 - Pan (Thurs 9:30AM)
 - Tian (Thurs 9:50AM)
 - Chahine (Thurs 10:40AM)
 - Wei (Thurs 11:40AM)
 - Chahine (Thurs 11:40AM)
- CO
 - McMillan (Thurs 11:20AM)
 - Wei (Thurs 11:40AM)
- CH₄
 - Xiong (Thurs 1:30PM)
- CO₂
 - Chahine (Thurs 10:40AM)
- SO₂
 - Hannon (Thurs 11:00AM)
- Dust
 - Machado (Thurs 2:20PM)

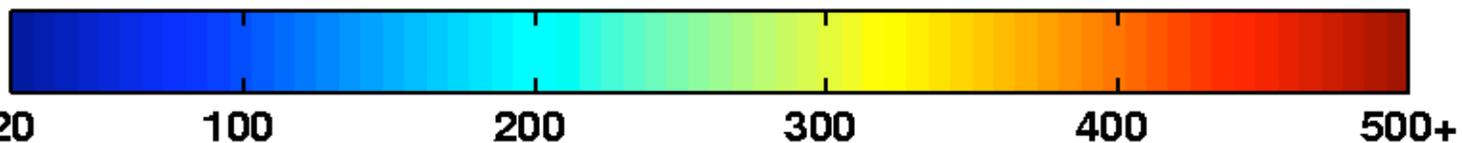
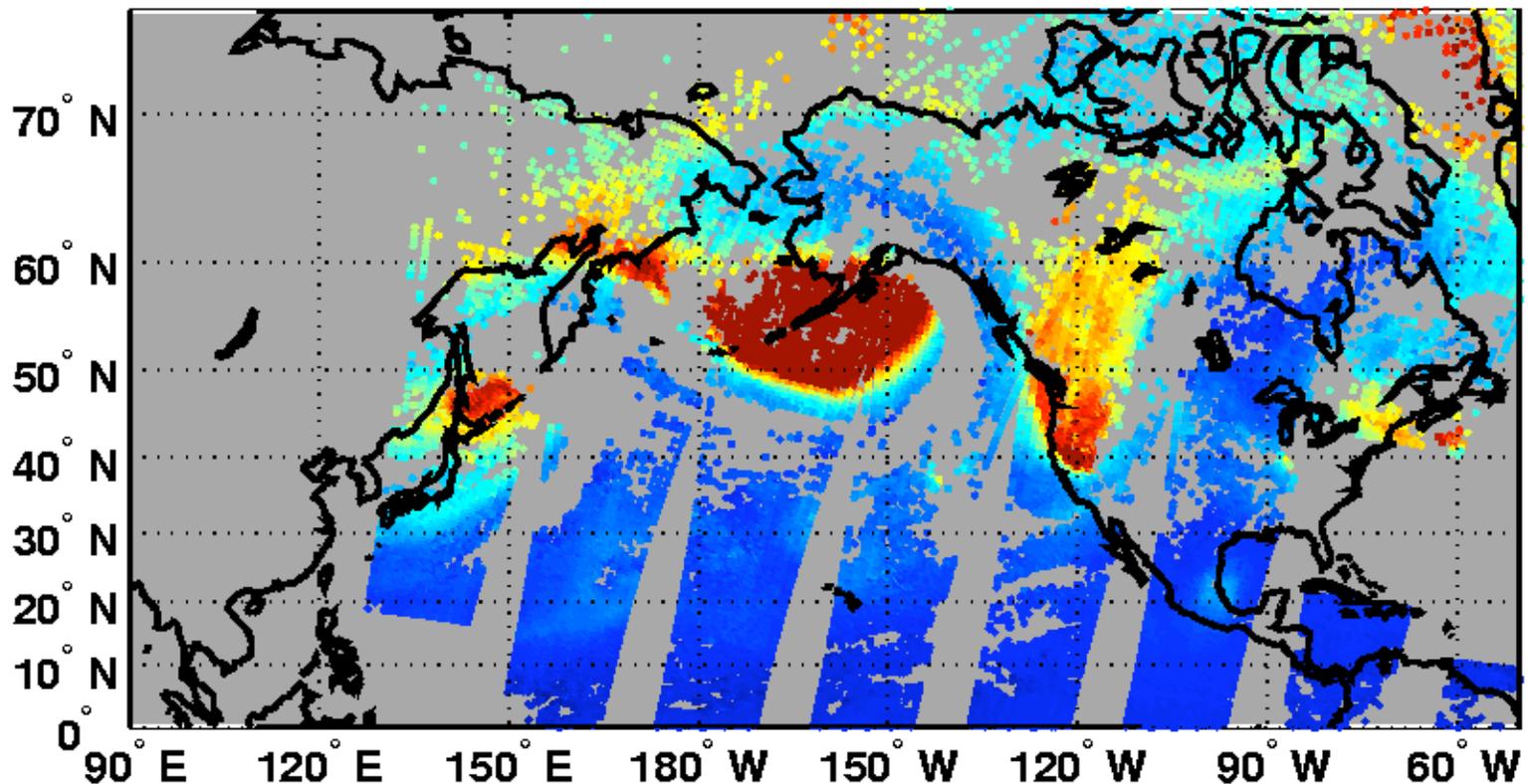
AIRS CO during INTEX-B

Local AP (day+night) AIRS CO at 500 mb on 20060417



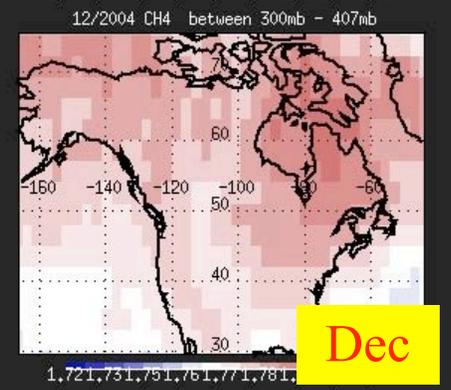
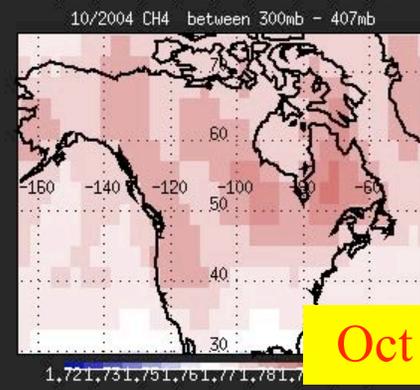
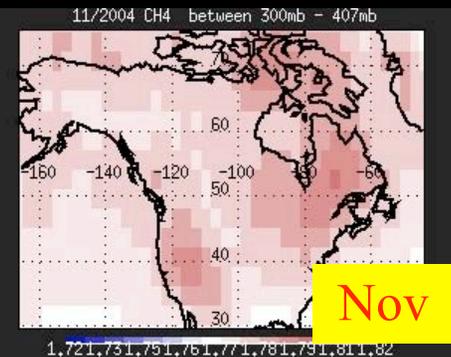
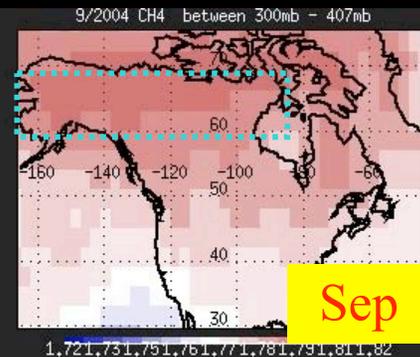
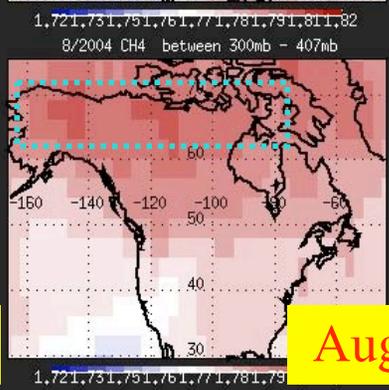
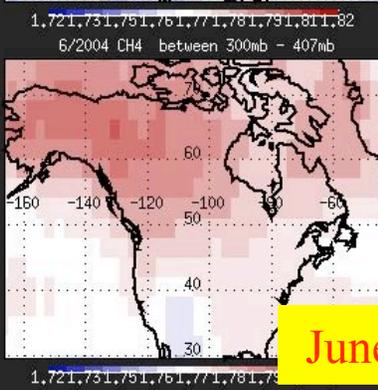
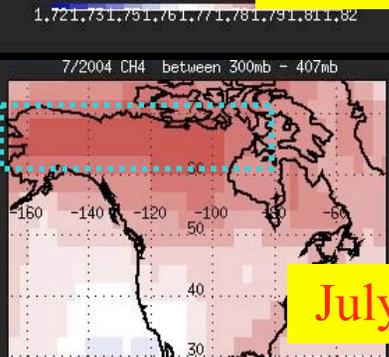
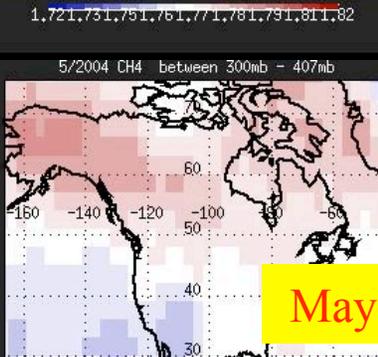
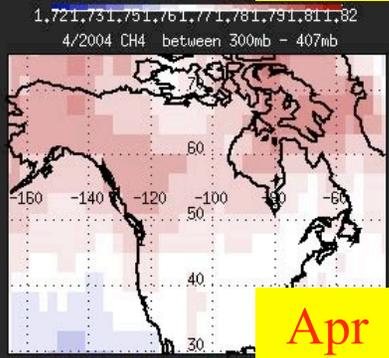
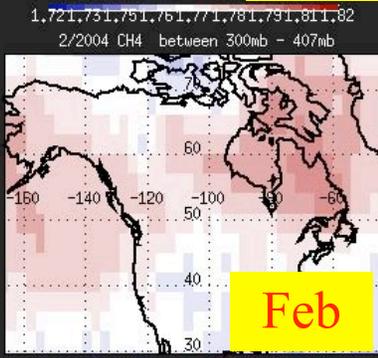
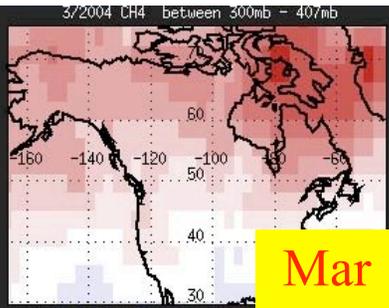
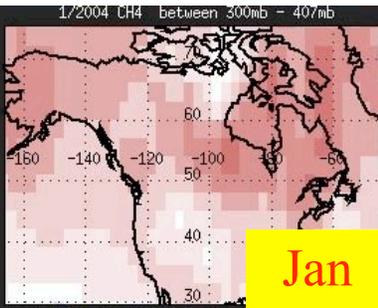
AIRS O₃ during INTEX-B

Local AM (descending) AIRS O₃ at 266 mb on 20060417

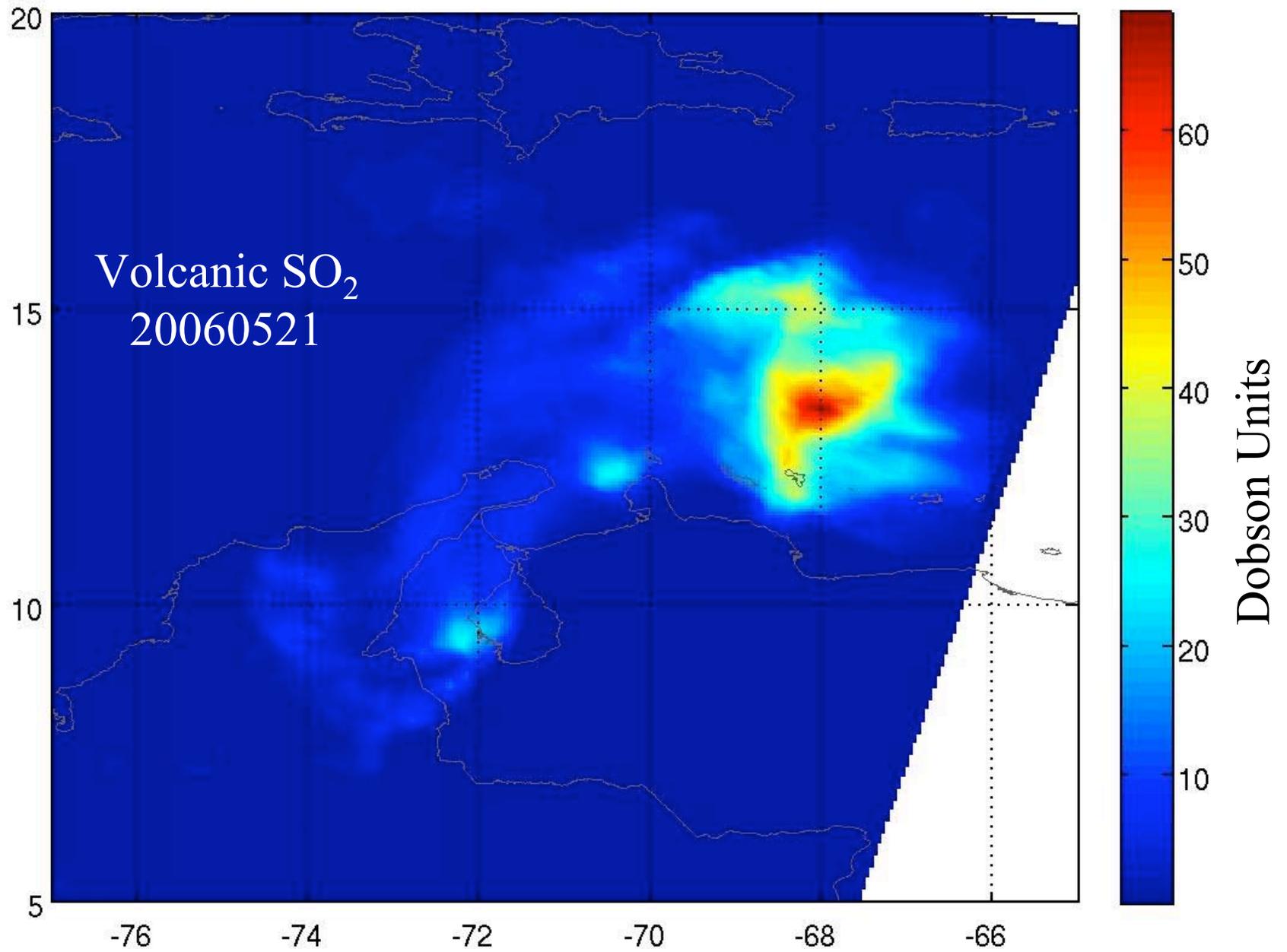


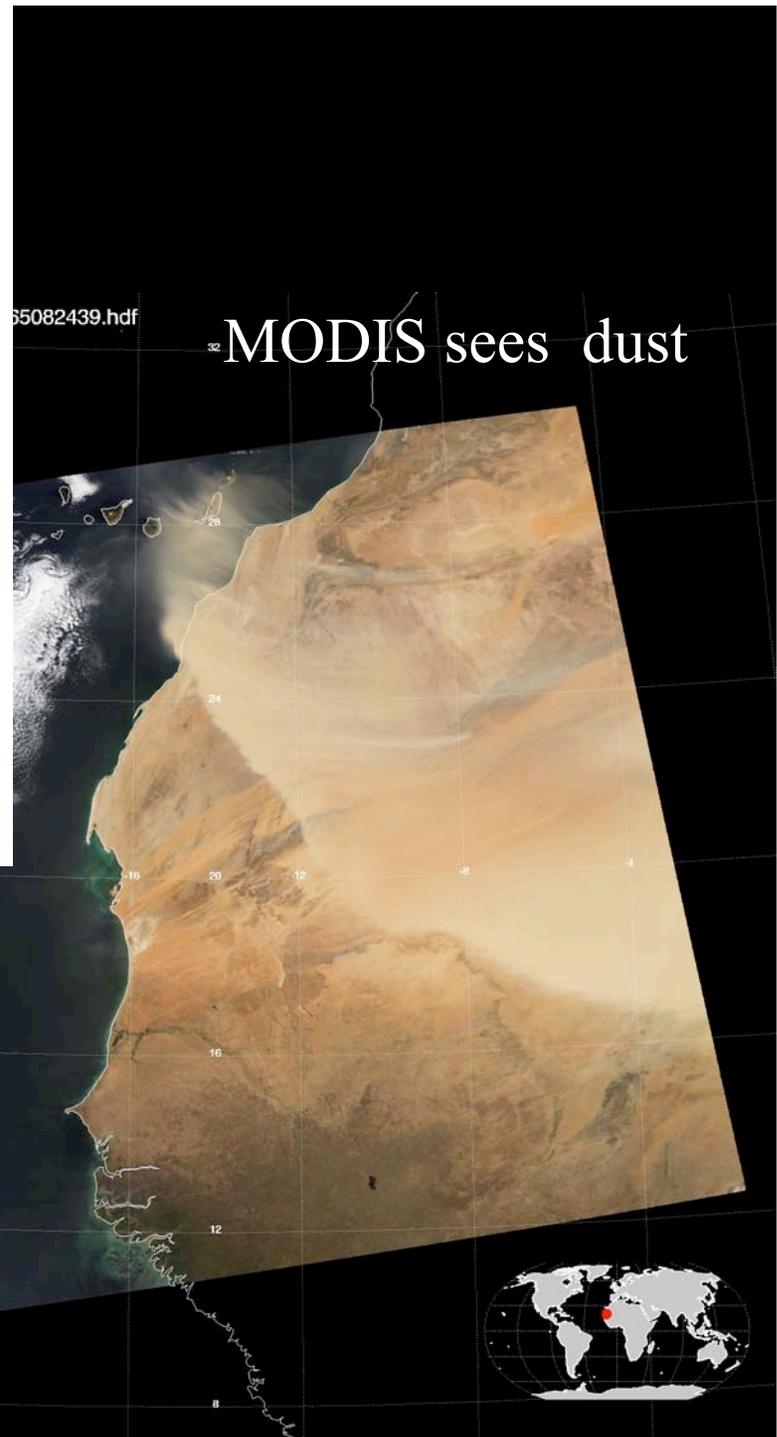
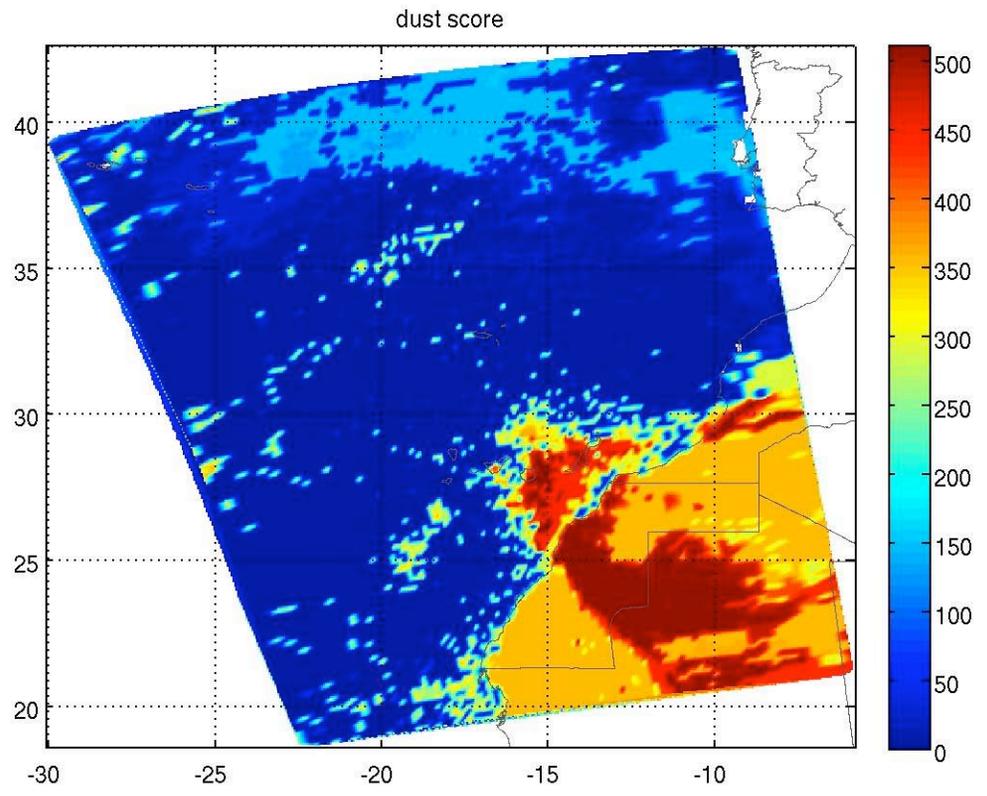
AK-CA, 2004 (CH₄ in 350 mb) Xiaozhen Xiong

Increase in July, Aug and Sept



Scott Hannon





AIRS Dust Score

Sergio DeSouza Machado

Minor Constituents: Issues

- **Verticality – Averaging Kernels**
 - Retrieval dependent
 - **Absolutely critical for modelers to use data!!**
 - Averaging Kernel says how perturbations in each trapezoid affect the retrieval $A = (9 \times 9)$
 - Verticality says how AIRS sees the total column (modelers already Beta testing) = sum of the rows of A
 - CO degrees of freedom = $\text{trace}(A)$
 - **AIRS v5 CO is compatible with what modelers already use (MOPITT)**

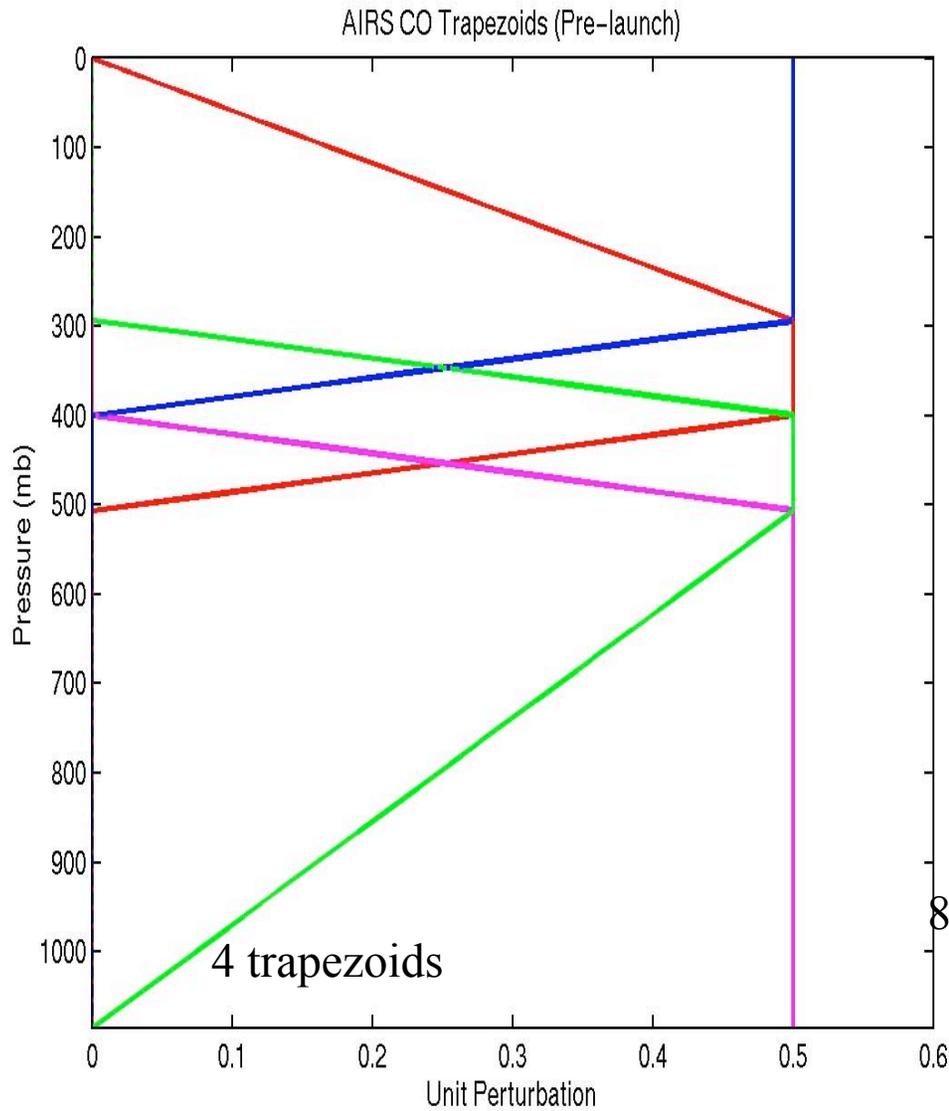
V5 New Outputs

- **Standard products**
 - CO_VMR_eff = 9 point vector
 - CO_eff_press = 9 point vector
 - CO_verticality = 9 point vector
 - CO_dof = 9 point vector
 - CO_retrap = number of trapezoids in retrieval
- **Support products**
 - CO_avg_kern = 9x9 matrix
 - CO_cd = 100 layer columns
 - CO_lev = AIRS layers, defines trapezoids

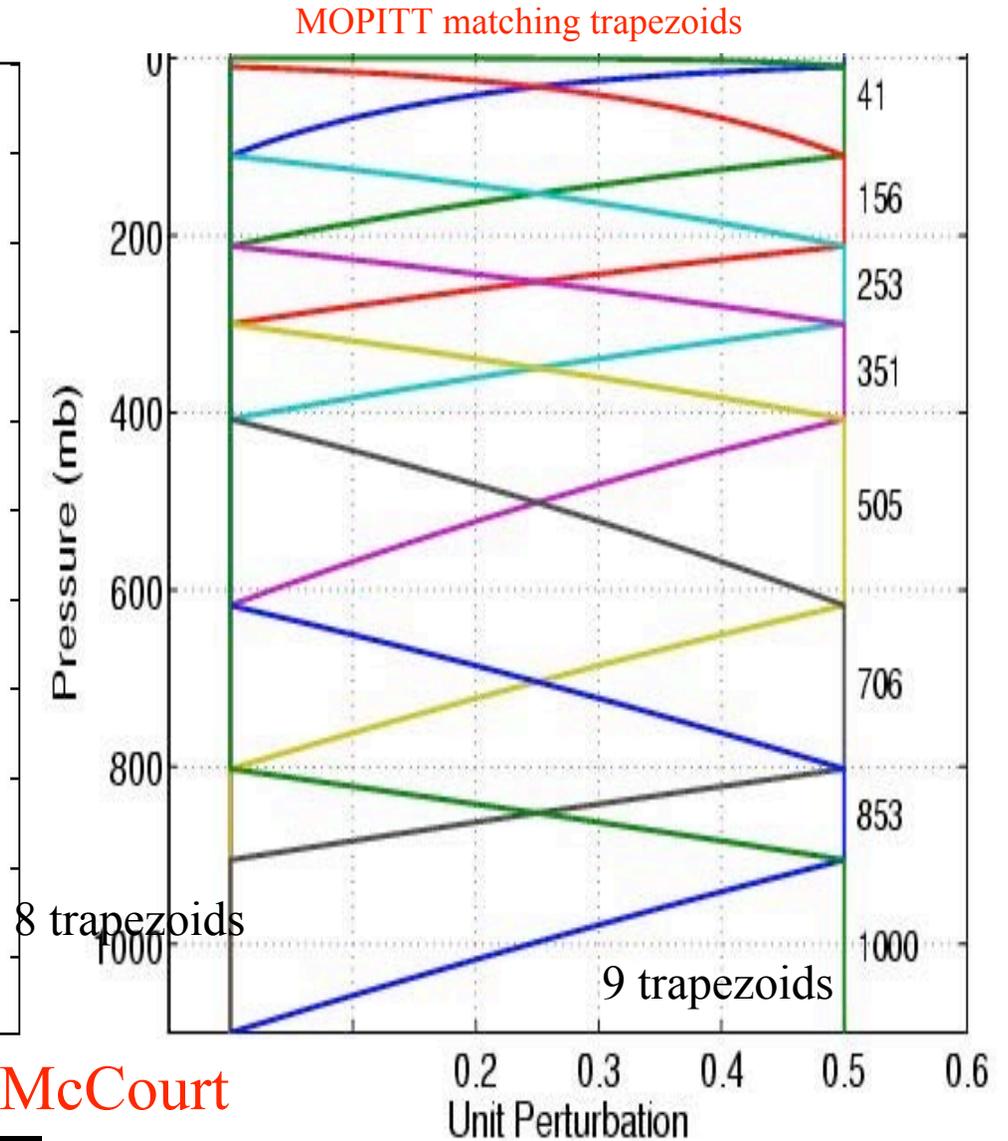
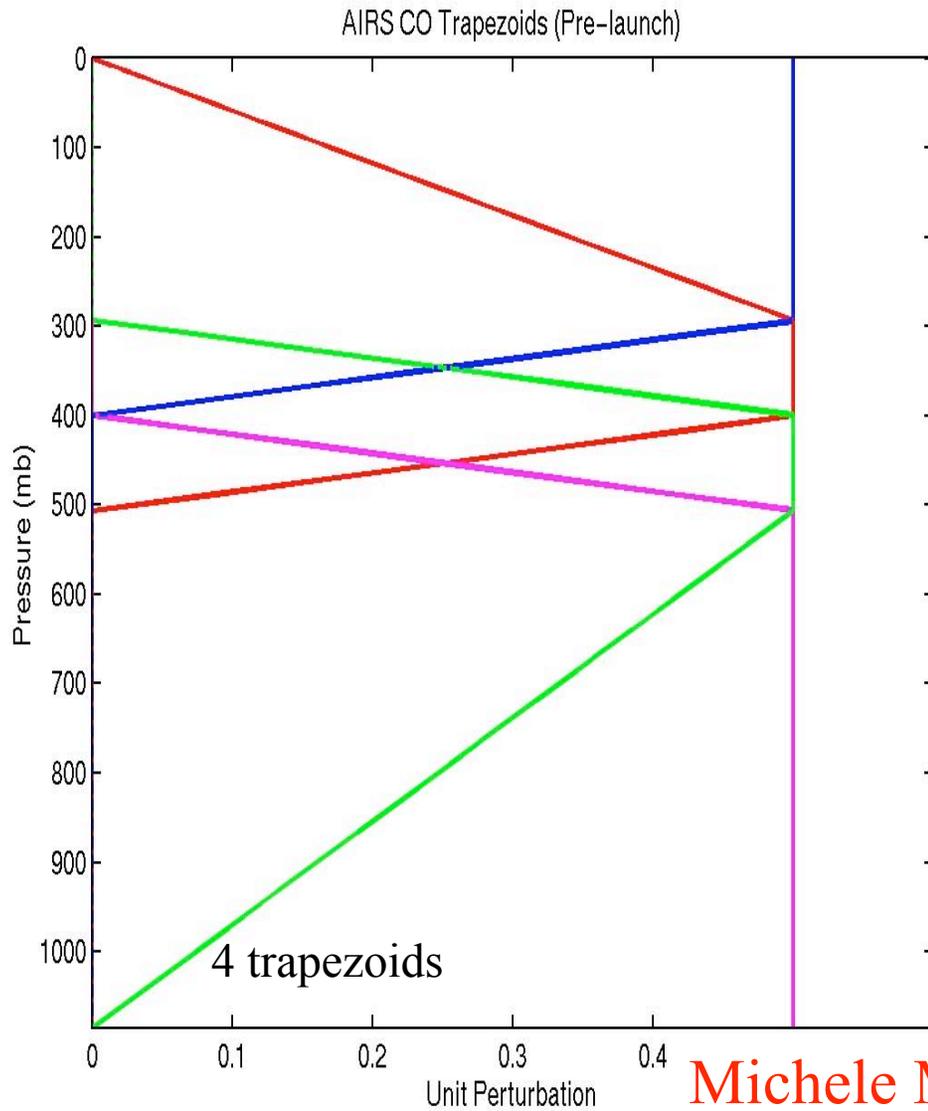
CO Update

- **Optimization (Michele McCourt Comer)**
 - **CMDL and MOZAIC profiles with complete averaging kernel convolution**
 - **9 trapezoids (pre-launch used 4)**
 - **Optimized damping parameter**
 - **v4.0 validated with 2003-2004 profiles**
 - **AIRS RMS < 15% on trapezoids**
- **Now evaluating v5 optimization**
- **MOPITT a priori profile**

AIRS CO Retrieval Vertical Functions

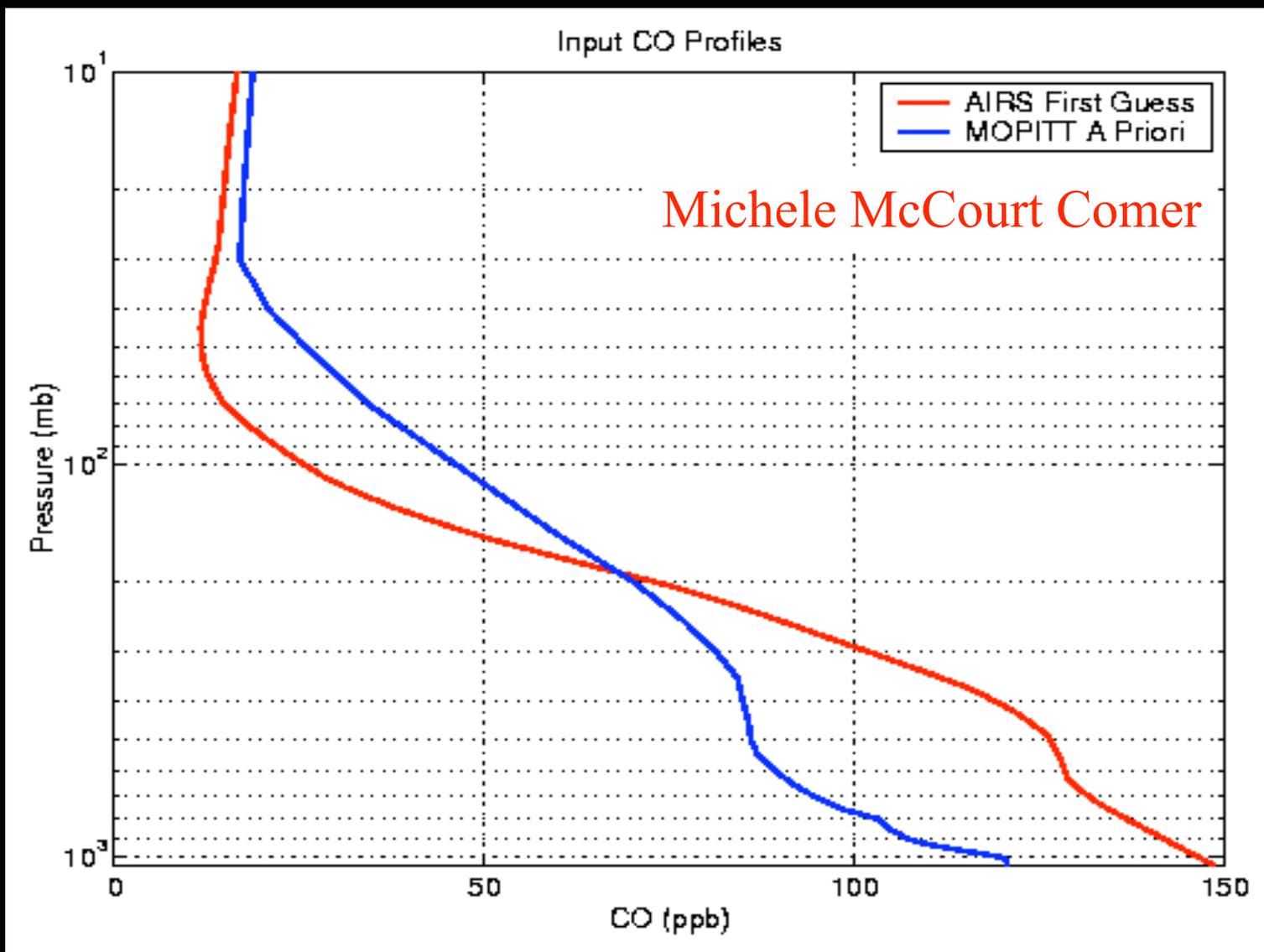


AIRS CO Retrieval Vertical Functions

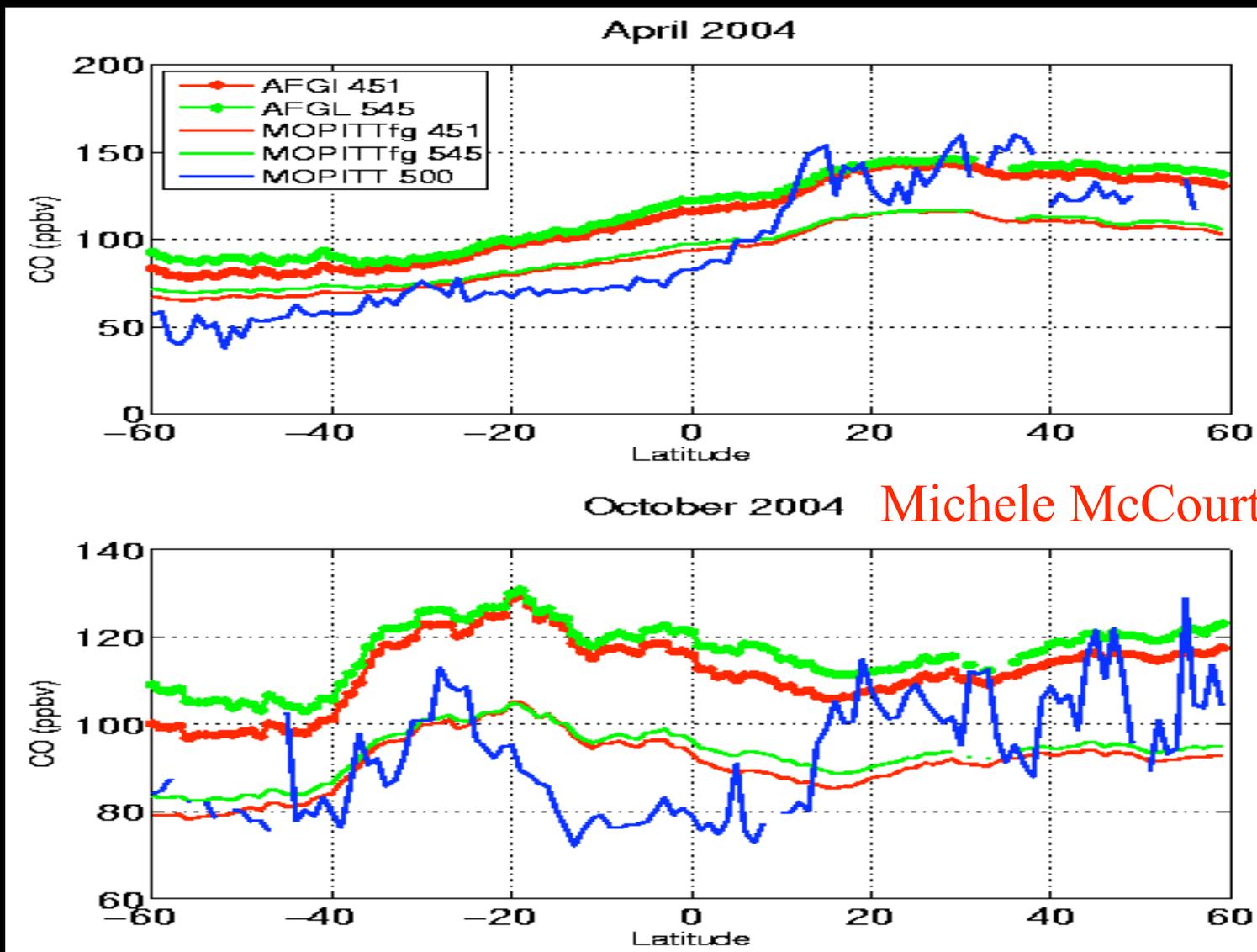


Michele McCourt
Comer

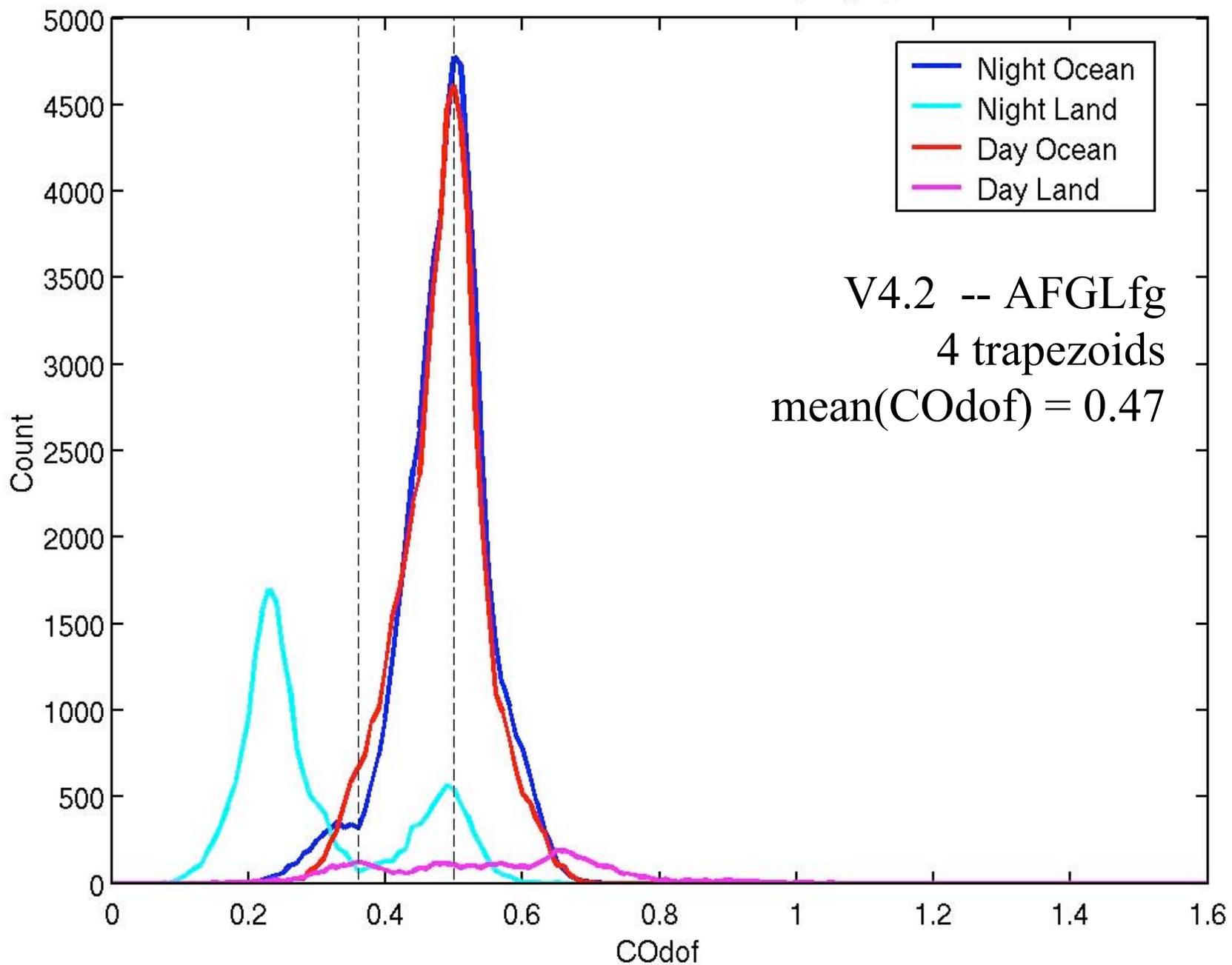
First Guess CO: AFGL vs. MOPITT



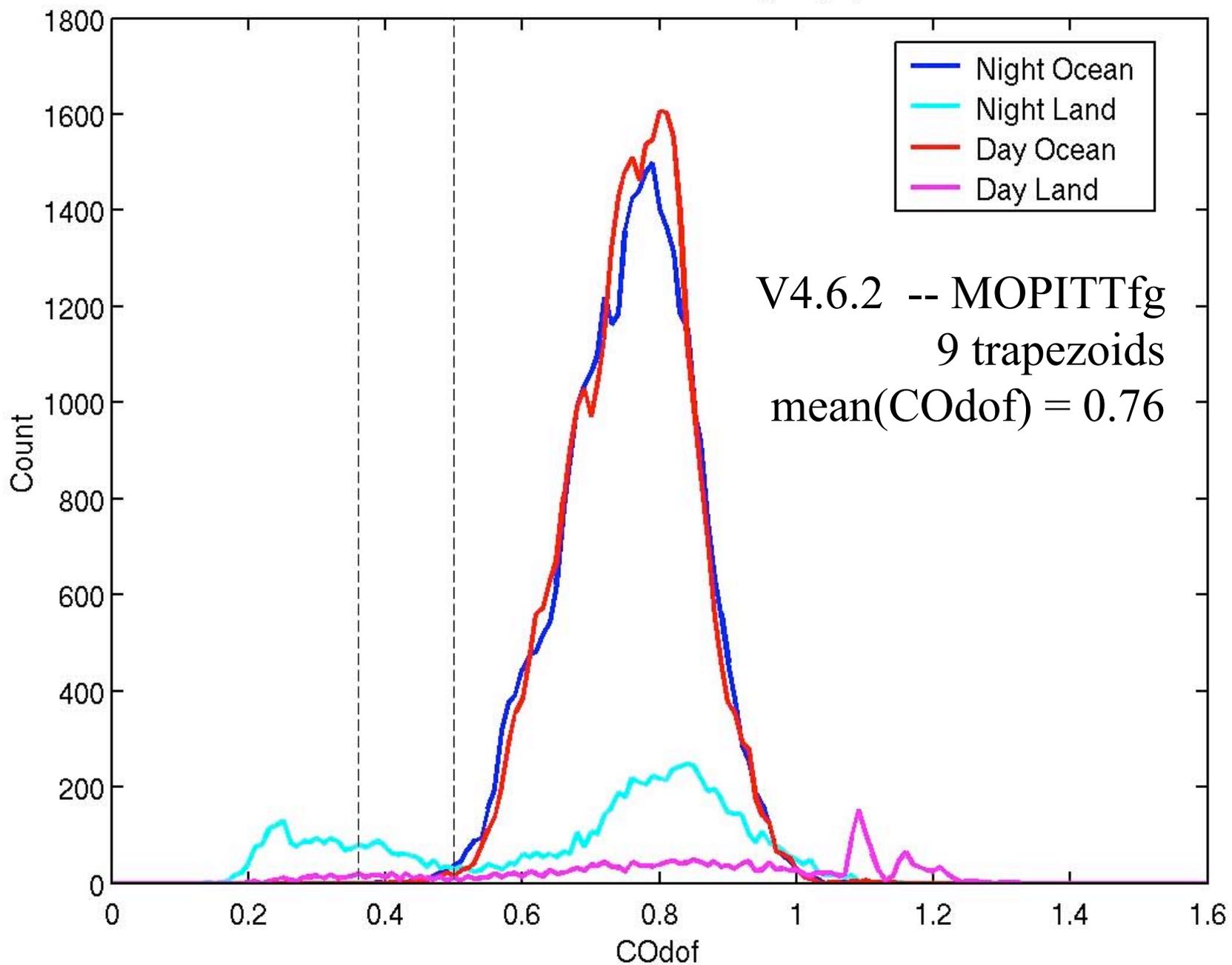
First Guess CO: AFGL vs. MOPITT



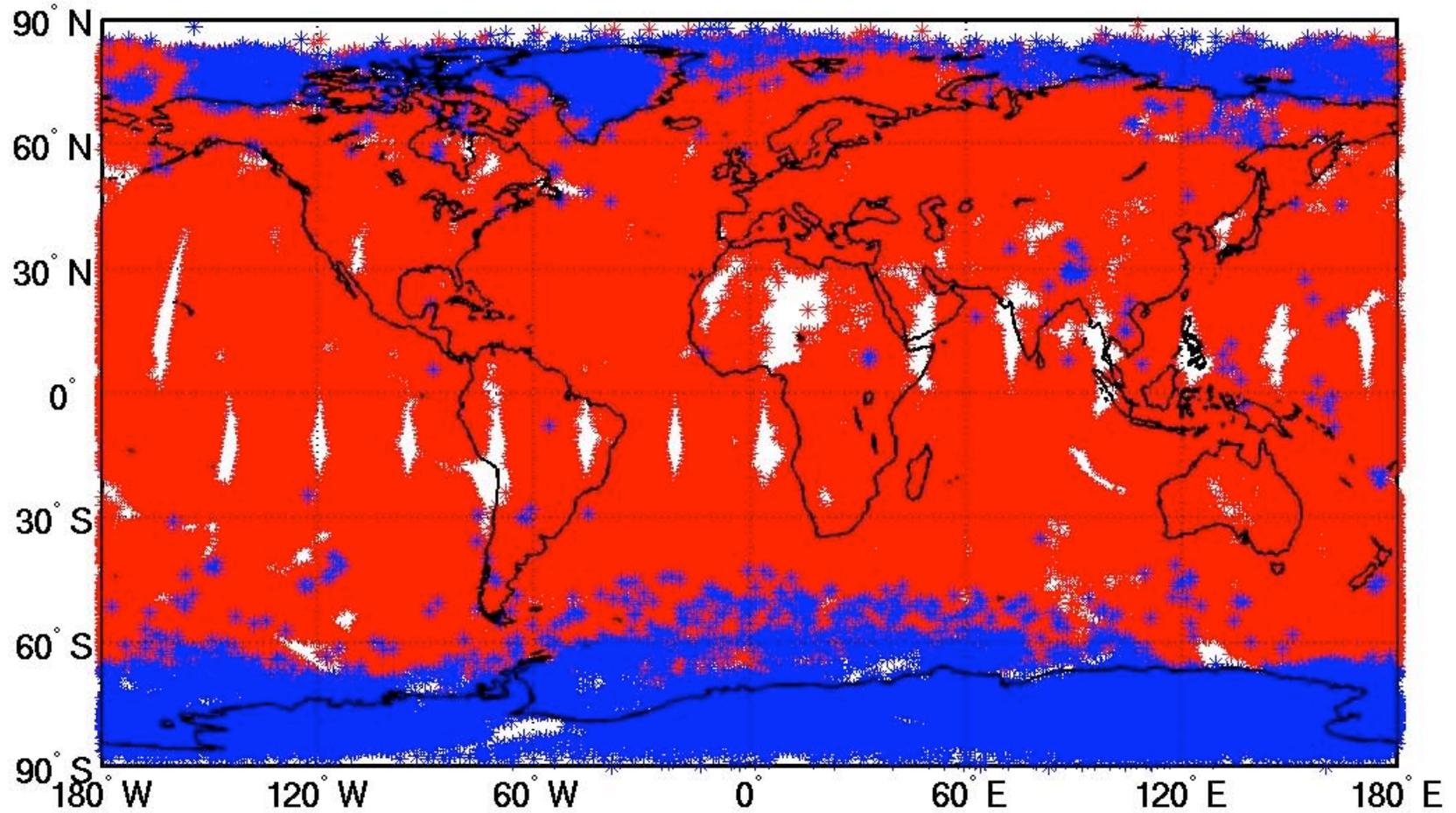
AIRS Global COdof for 20040801: v4.2 Day/Night, Ocean/Land



AIRS Global COdof for 20040801: Day/Night, Ocean/Land

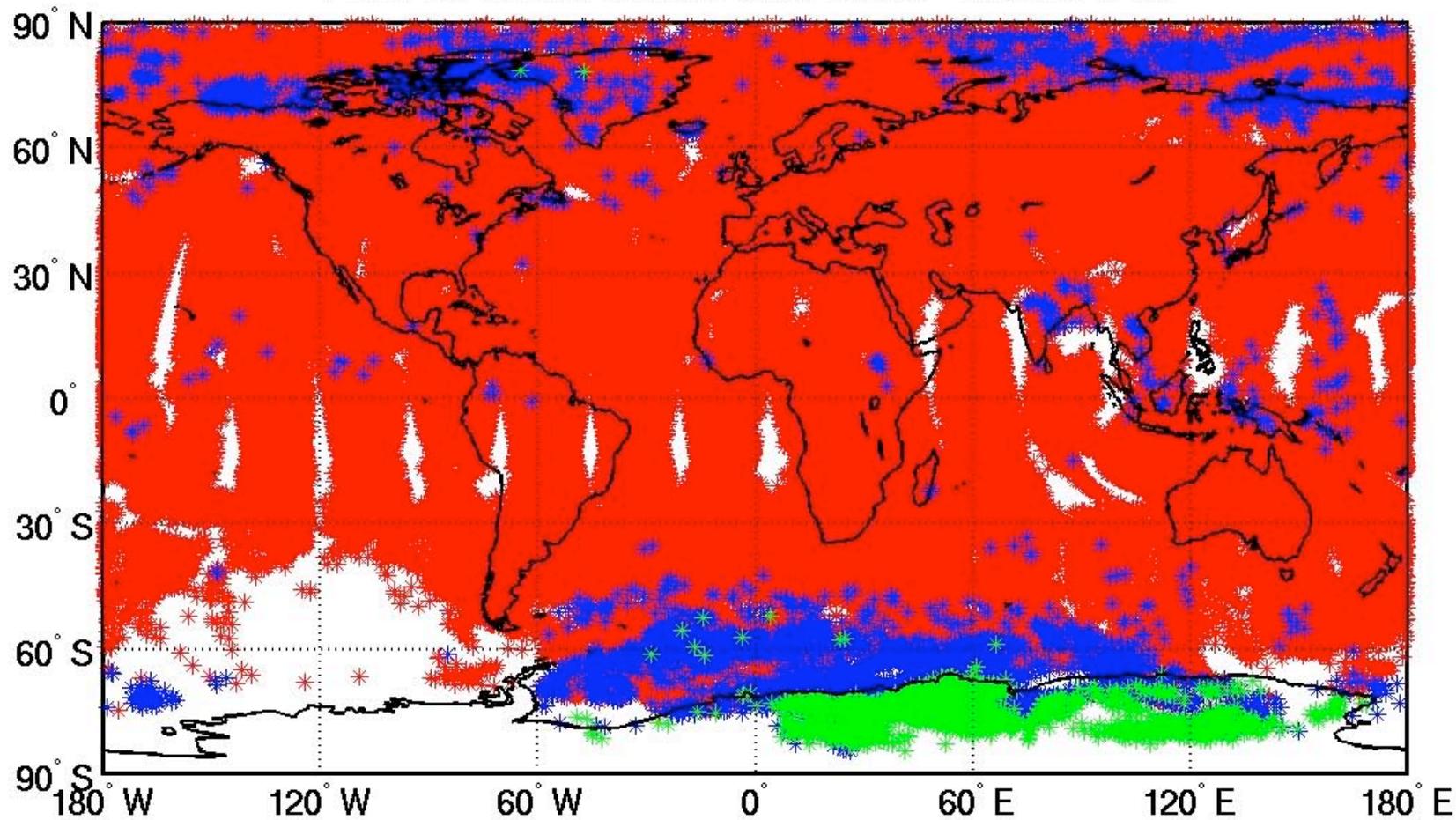


AIRS CO Global retrievals (blue COdof < 0.36): 20040801: v4.2



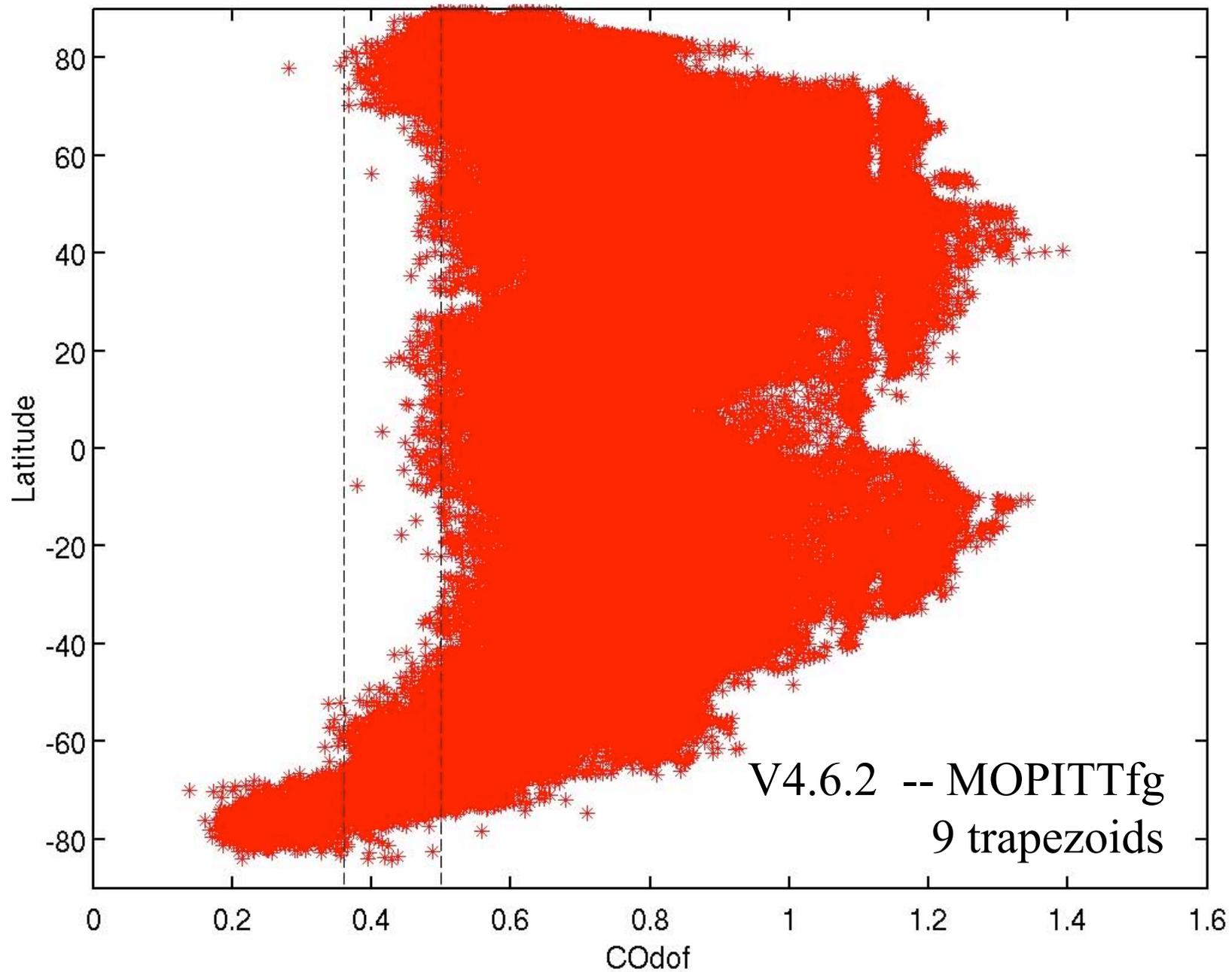
V4.2 -- AFGLfg and 4 trapezoids

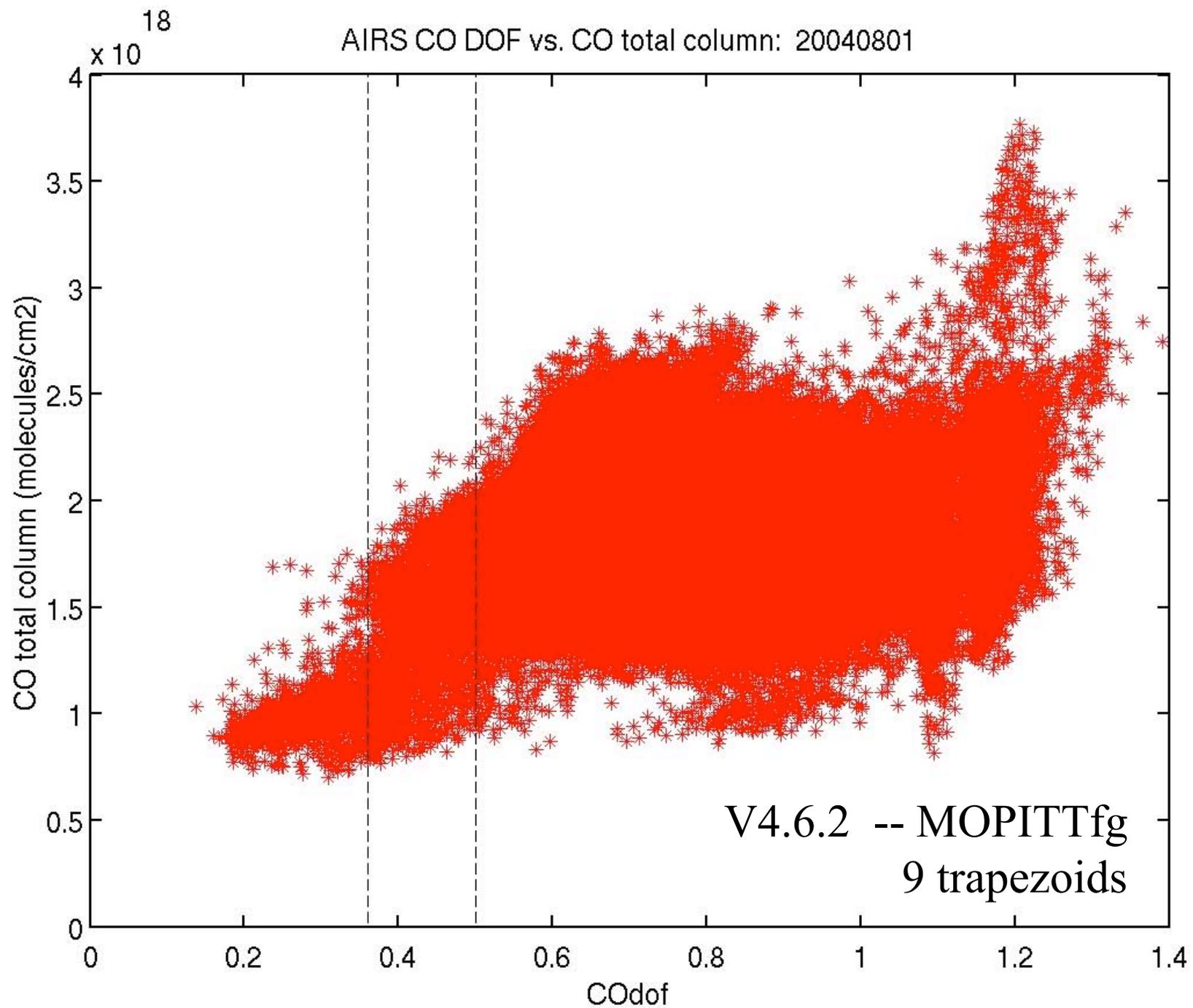
AIRS CO Global retrievals (blue COdof < 0.5): 20040801



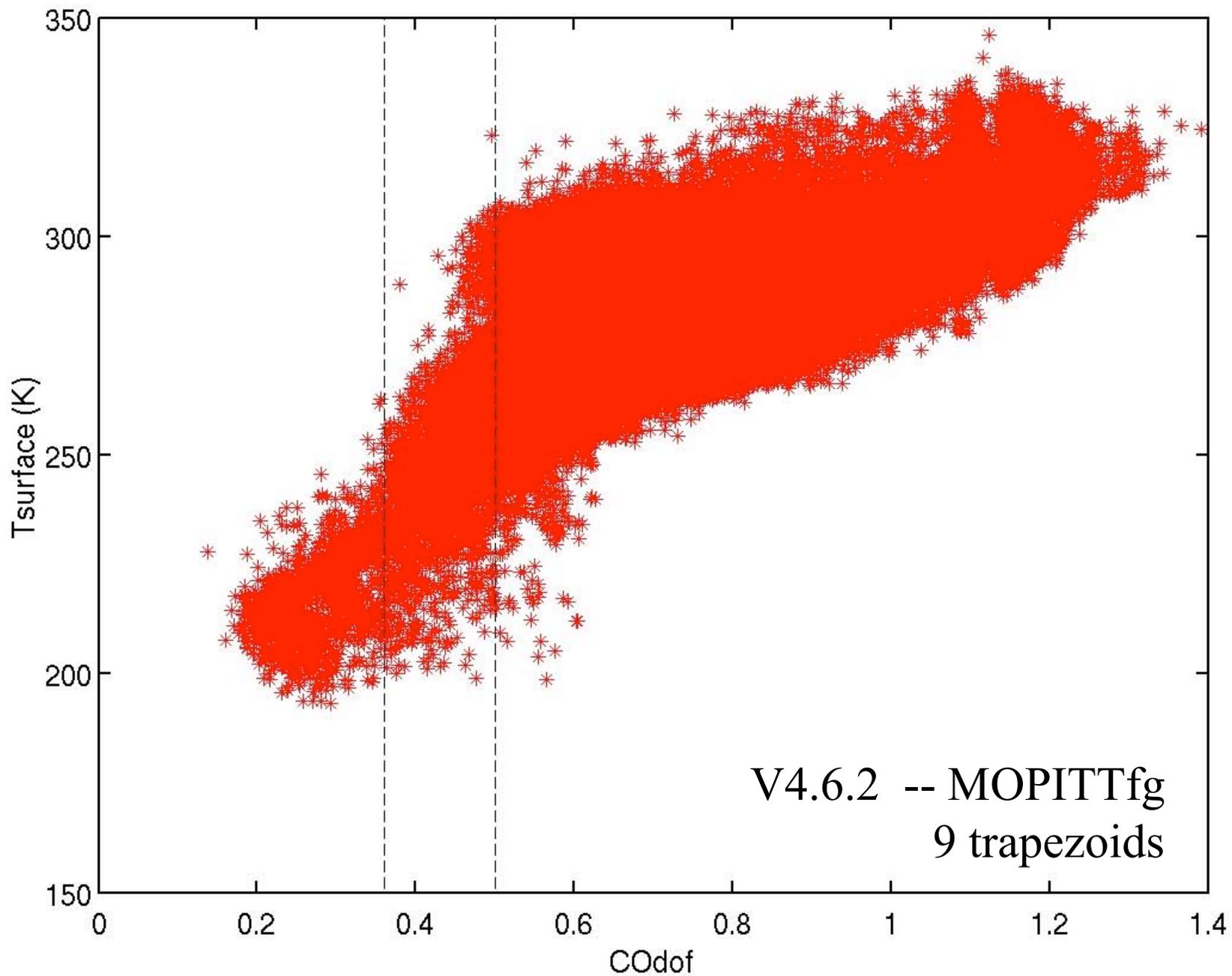
V4.6.2 -- MOPITTfg and 9 trapezoids

AIRS CO DOF vs. Latitude: 20040801

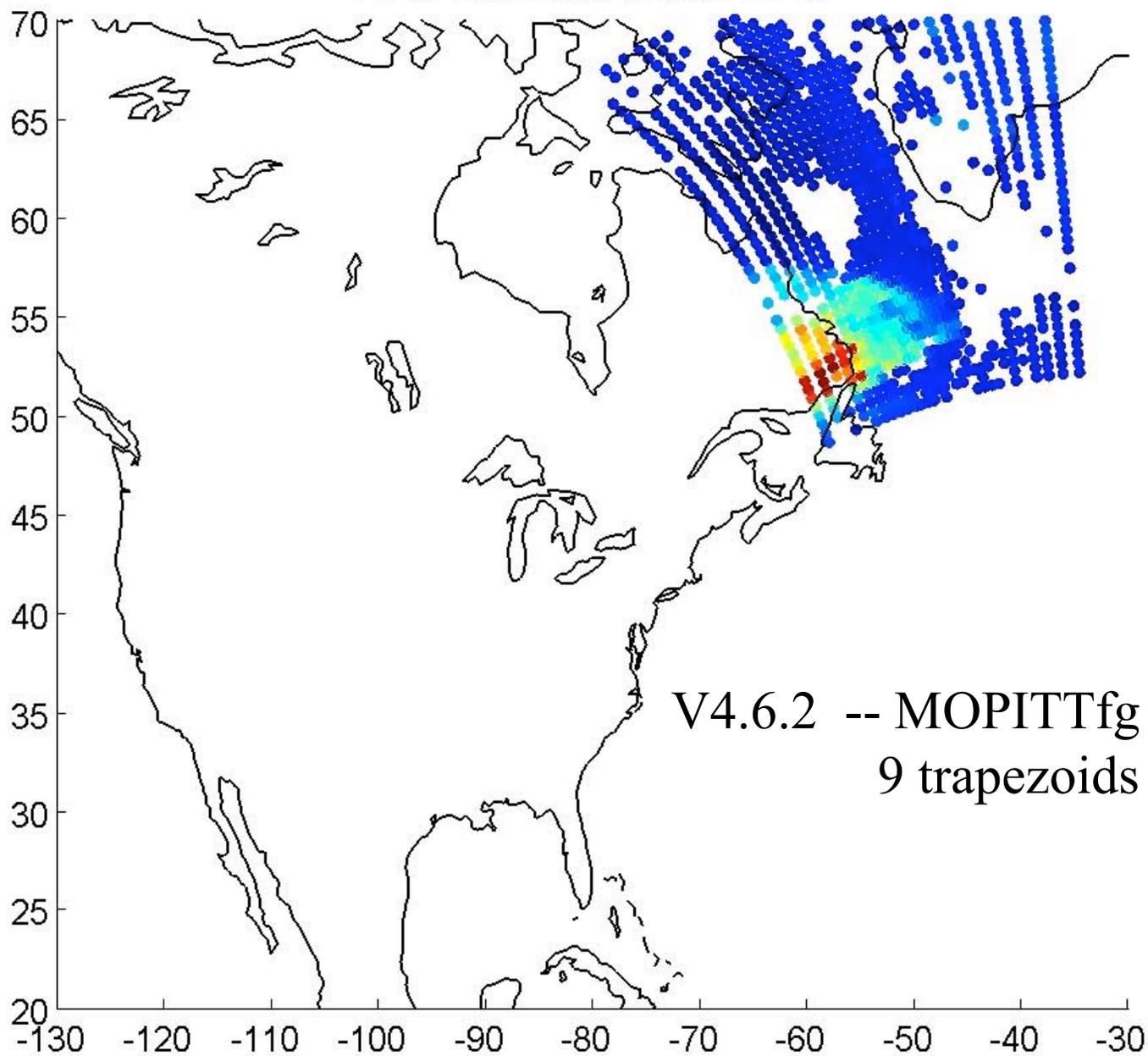




AIRS CO DOF vs. T_{surface}: 20040801

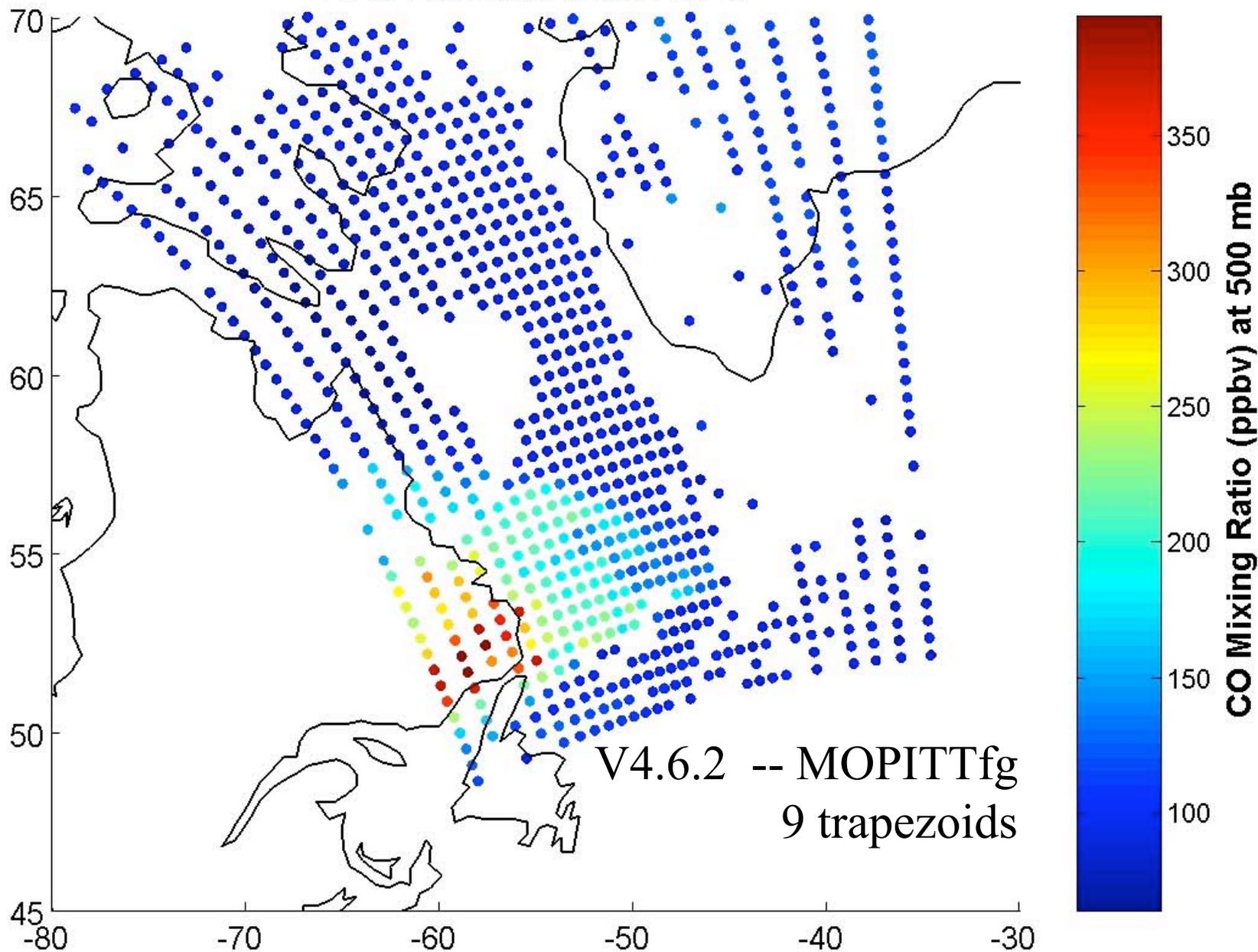


AIRS 500mb CO on 20040718

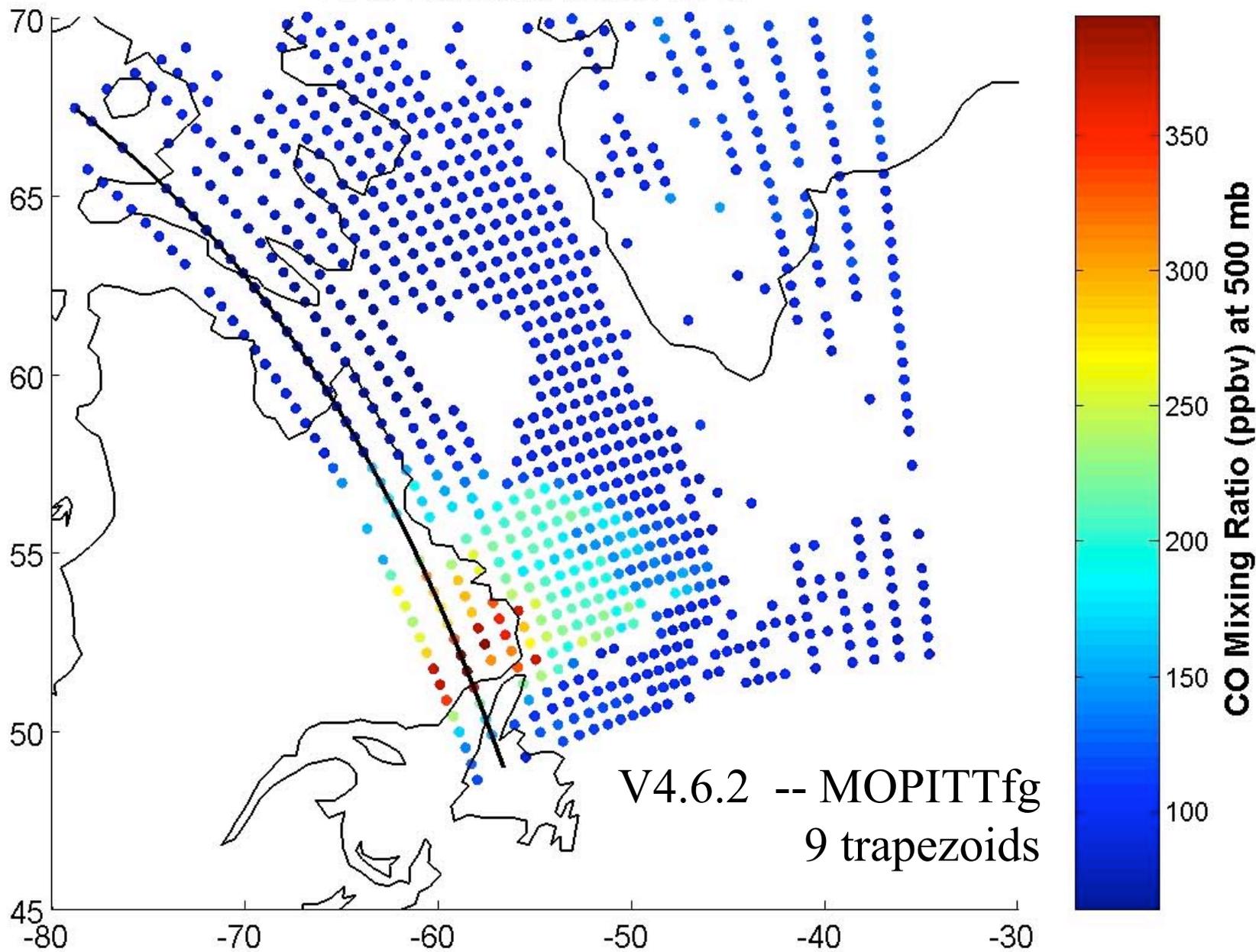


CO Mixing Ratio (ppbv) at 500 mb

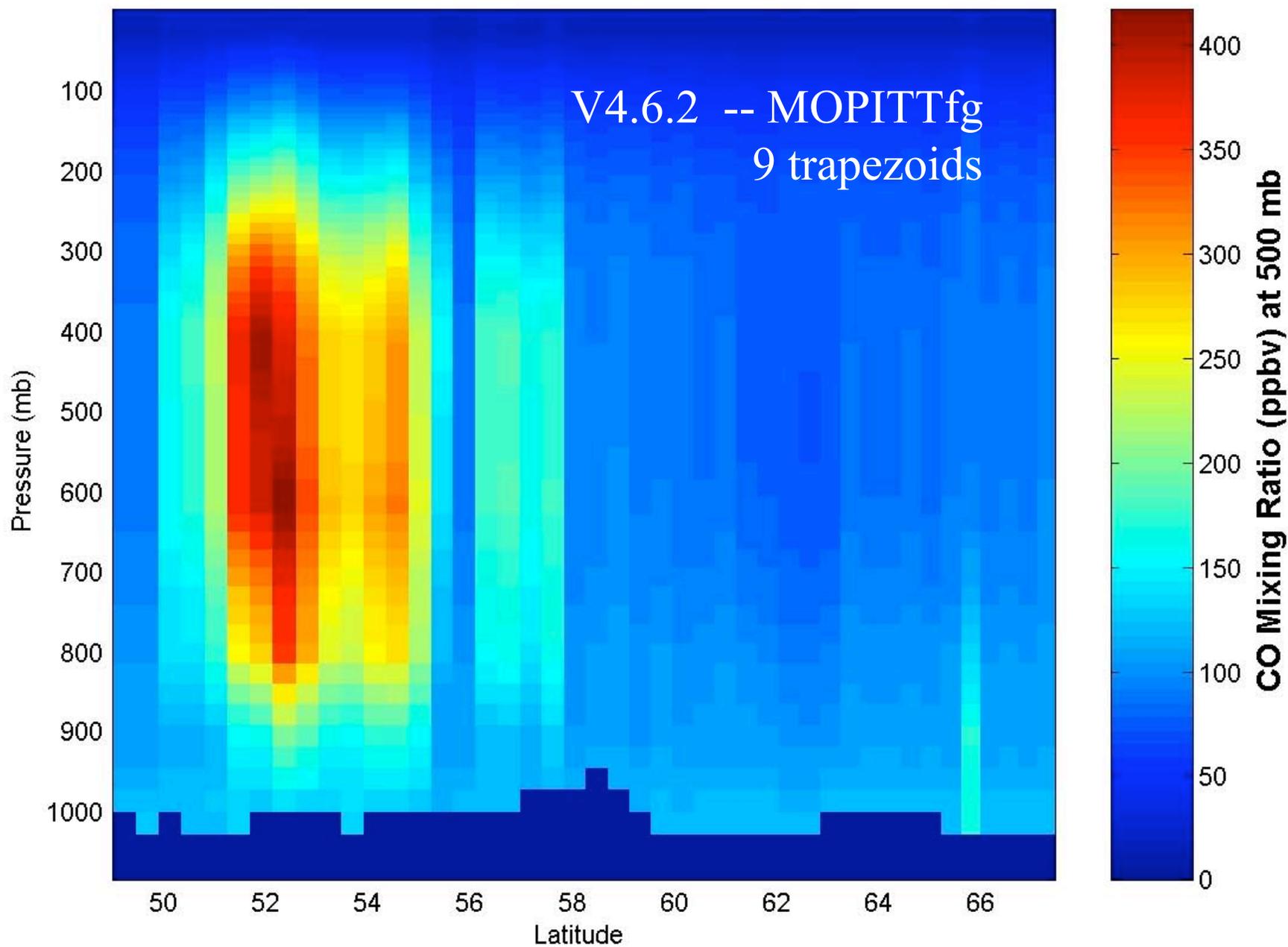
AIRS 500mb CO on 20040718



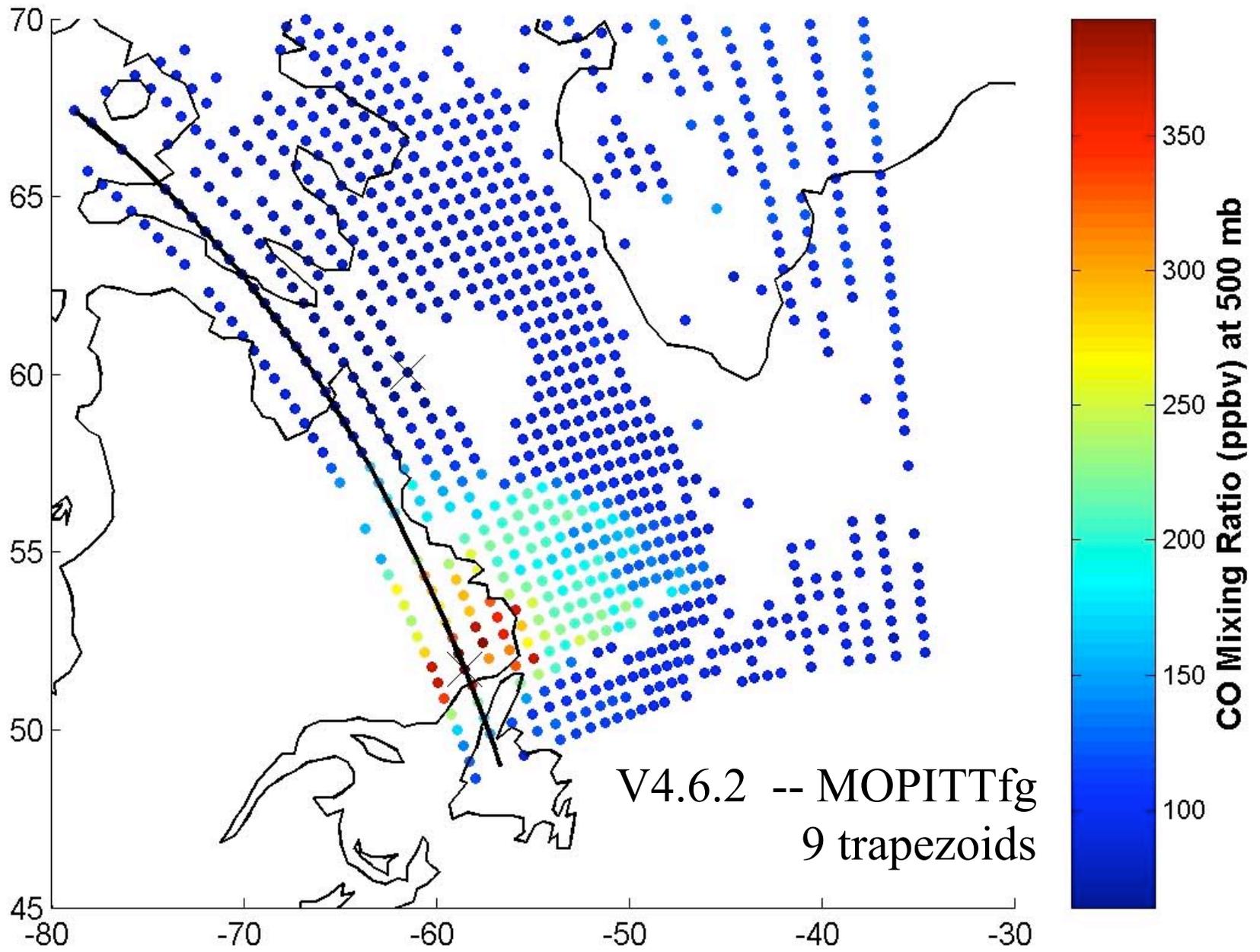
AIRS 500mb CO on 20040718



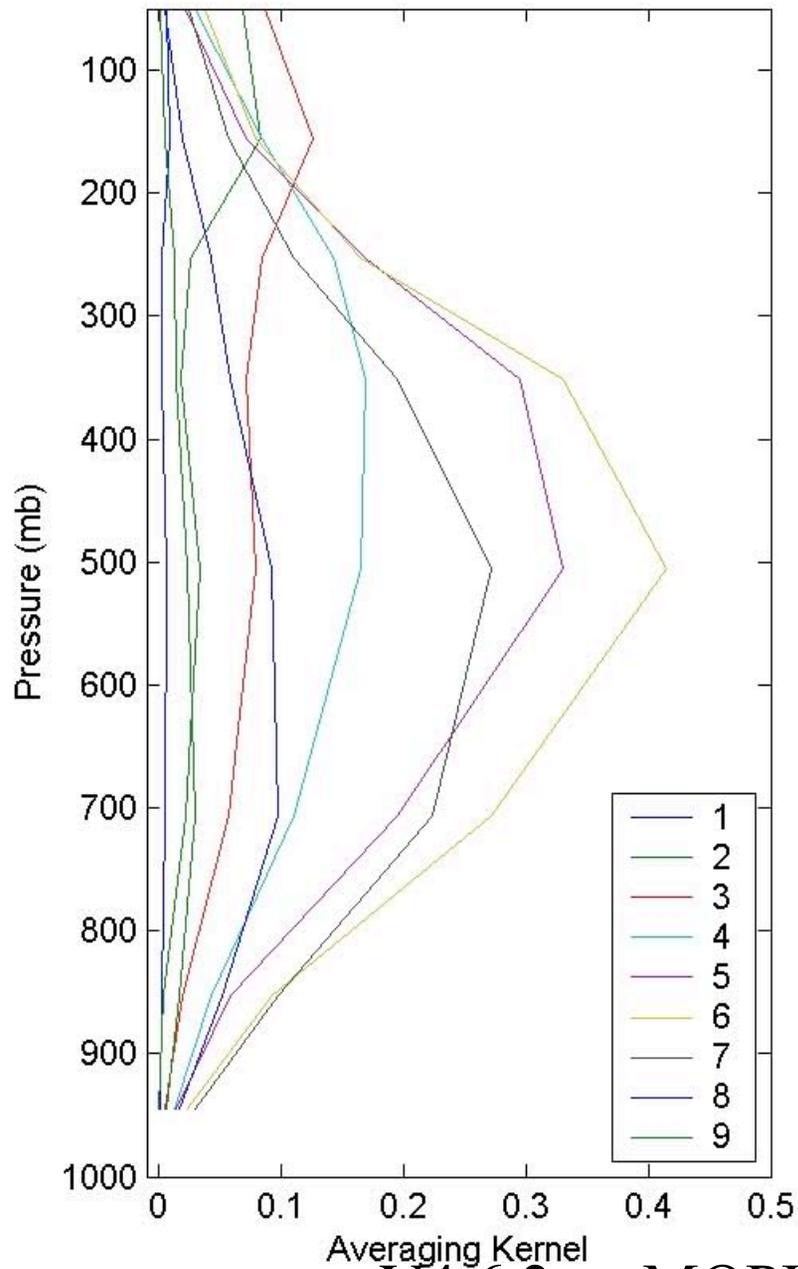
AIRS CO retrieved Cross-Section: 20040718



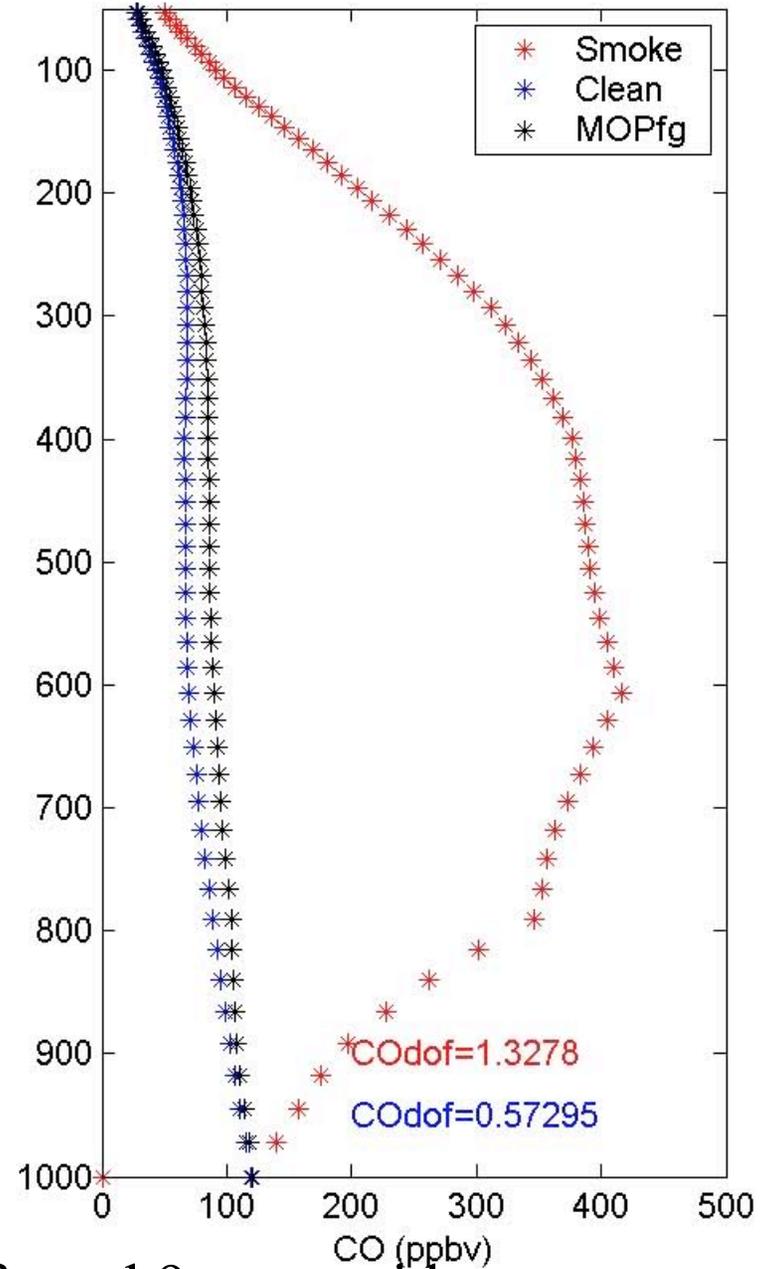
AIRS 500mb CO on 20040718



Smoky AIRS Spectrum on 20040718

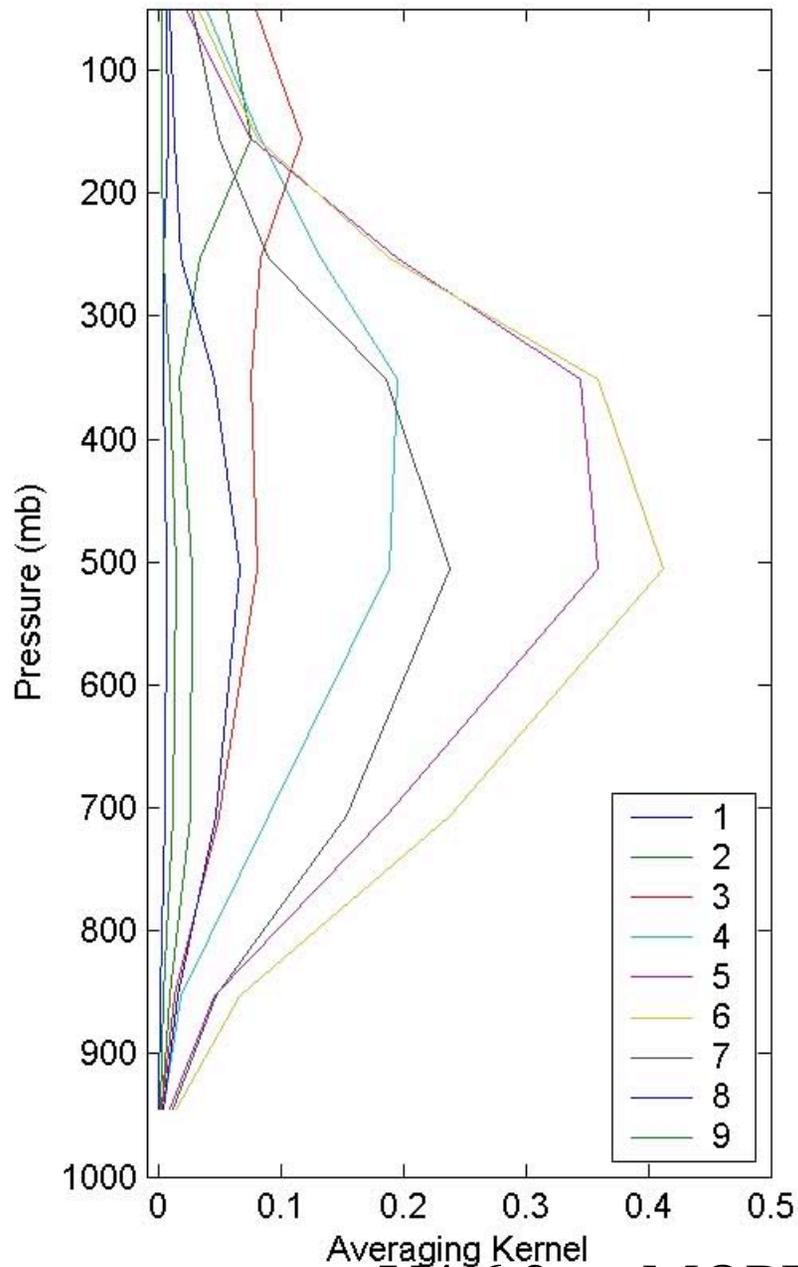


off Newfoundland (G160L182 and G009L695)

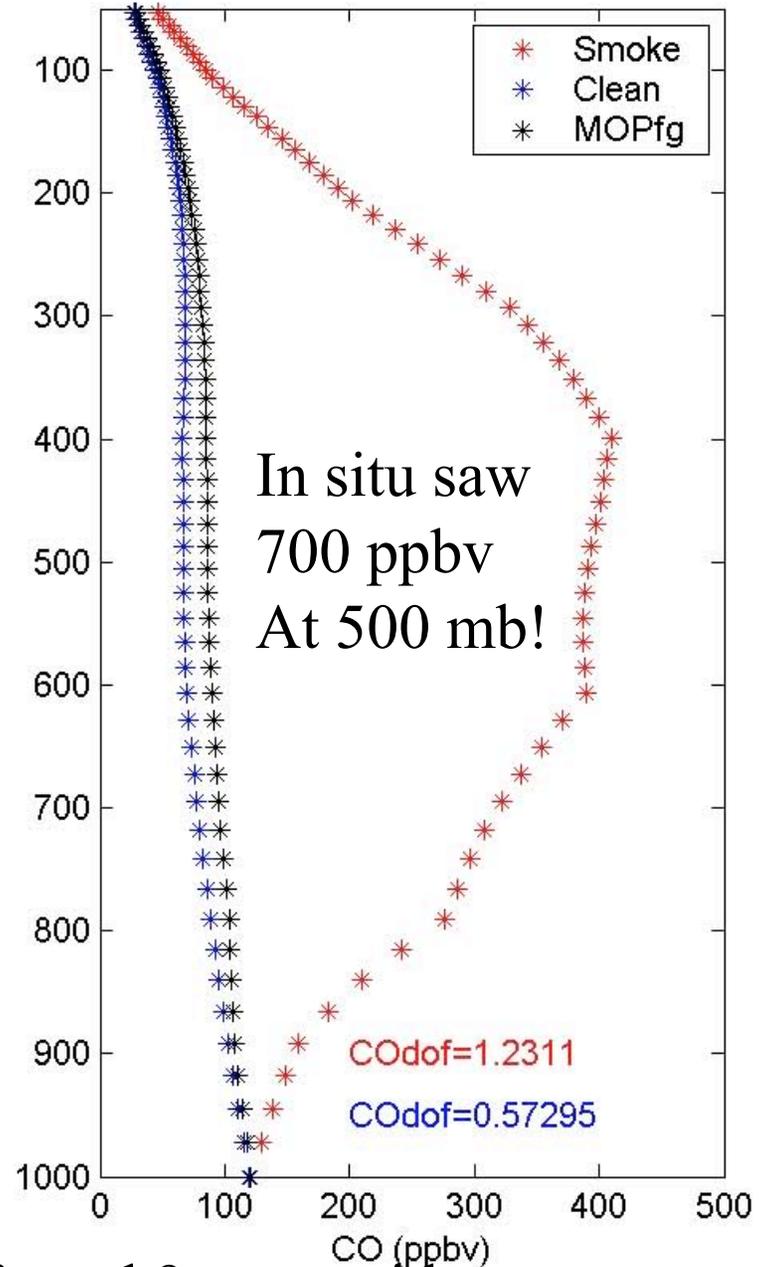


V4.6.2 -- MOPITTfg and 9 trapezoids

Smoky AIRS Spectrum on 20040718

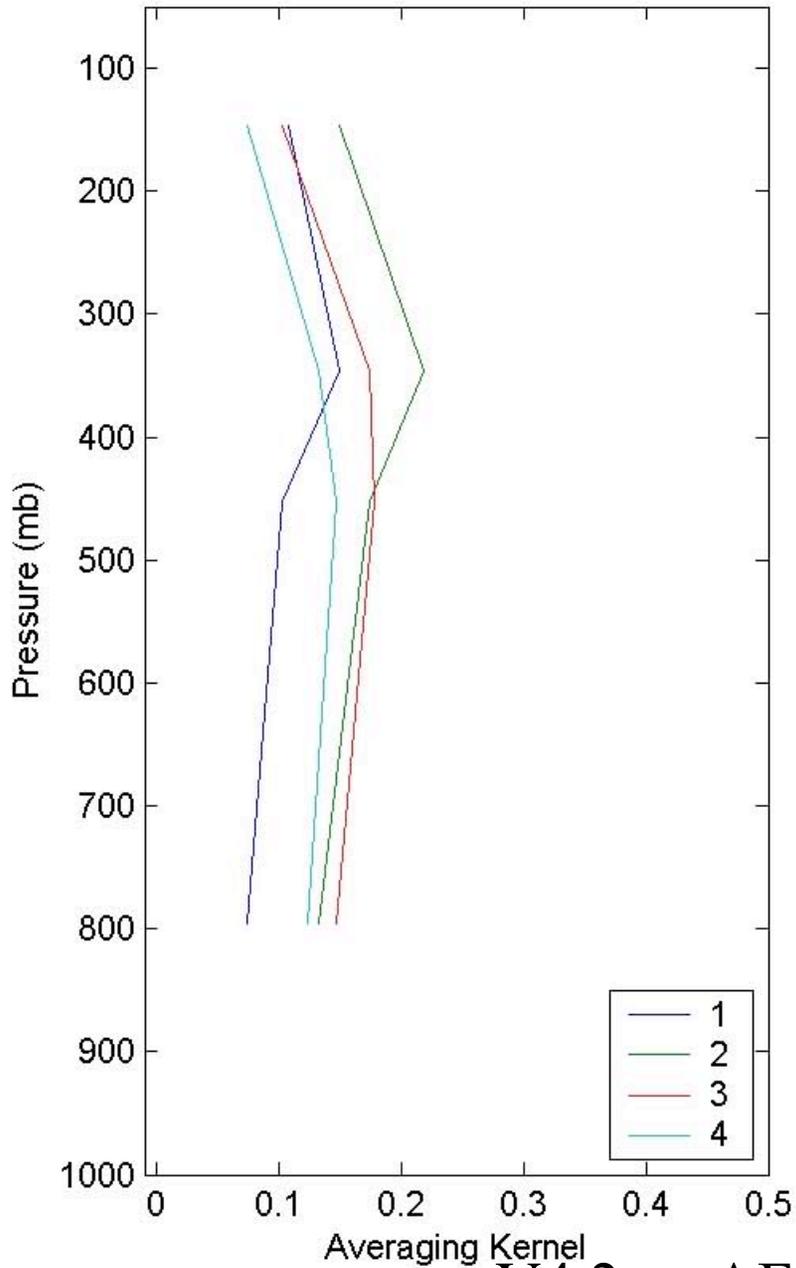


off Newfoundland (G160L182 and G009L695)

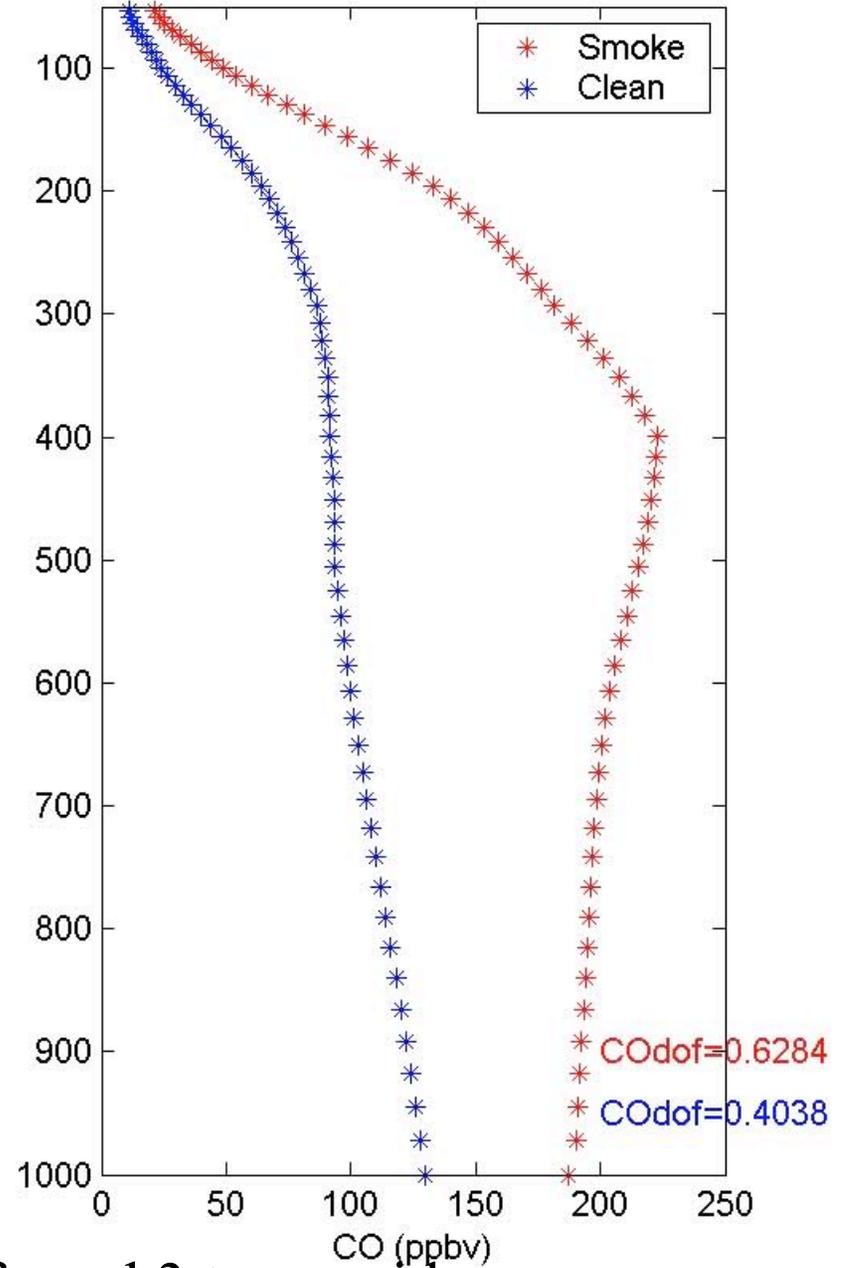


V4.6.2 -- MOPITTfg and 9 trapezoids

Smoky AIRS Spectrum on 20040718



off Newfoundland (G160L182 and G009L695)



V4.2 -- AFGLfg and 3 trapezoids

Summary

- CO v5 Standard Product
- CH₄ v5 Standard Product
- SO₂ v5.0 flag, L1B PGE; retrieval v6.0?
- dust v5.0 score, L1B PGE; retrieval v6.0?
- H₂O averaging kernel output in v5
- O₃ averaging kernel output in v5
- CO₂ v5 Support Product
- HNO₃ column retrieval for v6?
- N₂O column retrieval for v6?
- CFC's little signal apparent in data